FROM VITAMIN D TO HORMONE D:
FUNDAMENTAL OF THE VITAMIN D ENDOCRINE SYSTEM IN
RELATION TO GOOD HEALTH

Abstract:
Vitamin D is essential for life in higher animals. Classically it has been shown to be one of the most
important biological regulators of calcium metabolism and homeostasis via stimulating the intestinal
absorption of calcium, facilitating the deposit of calcium in bone, and regulating the excretion of calcium
by the kidney.

The molecular structure of vitamin D is closely allied to that of classical steroids (cholesterol) and
steroid hormones (e.g., estrogens, glucocorticoids, etc). Current evidence supports the concept that the
classical biological actions of the nutritionally important fat soluble vitamin D in mediating calcium
homeostasis are not mediated by the parent vitamin D, but by a vitamin D endocrine system which
coordinates the metabolism of vitamin D into the steroid hormone 1,25(OH)₂-vitamin D (referred to here
as hormone D). Hormone D, like other steroid hormones, can only generate biological responses via
interacting with its partner receptor, the vitamin D receptor (VDR) to form a hormone-receptor complex,
that interacts selectively with genes to regulate the production of new proteins that are involved in the
appearance of the biological response (e.g. stimulation of intestinal calcium absorption).

It is now clear that our body’s target organs which possess the VDR include many more tissues than the
classical intestine, bone, and kidney. The VDR is also present in the pancreas, pituitary, skin, breast
tissue, placenta, hematopoietic cells, immune cells and cancer cells of various origins. Key advances in
understanding the mode of action of the hormone D have been made by a thorough study of the VDR
as a classical nuclear receptor as well as the emerging studies describing the presence of the VDR in
the plasma membrane.

There are clinical applications for hormone D or related drug forms of hormone D for treatment of the
bone diseases of renal osteodystrophy, osteomalacia and osteoporosis, as well as psoriasis, and
hypoparathyroidism; other clinical targets for hormone D currently under investigation include its use in
leukemia, breast, prostate and colon cancer as well as an immunosuppressive agent.

Scientists and nutrition experts agree that about half of the elderly in North America and two-thirds of
the rest of the world are not getting enough vitamin D to maintain a healthy bone density, that will lower
their risks for fractures. Probably the nutritional Recommended Dietary Allowance (RDA) for vitamin D
should be adjusted upwards from the presently approved RDA of 400 IU to levels as high as 2000 IU.

Bio:
ANTHONY W. NORMAN, Distinguished Professor of Biochemistry and Biomedical Sciences,
University of California, Riverside; B.A., 1959 Oberlin College; M.S., 1961, Ph.D., 1963 University of
Wisconsin, Madison. Research Interests: Mechanism of action of the steroid hormone 1,25(OH)₂-
vitamin Ds; vitamin D structure-function relationships, actions of the vitamin D receptor (VDR).